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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/813,532	03/30/2004	Kuang Hsi-Wu	29171/39345	5318
4743	7590	07/24/2006	EXAMINER	
MARSHALL, GERSTEIN & BORUN LLP 233 S. WACKER DRIVE, SUITE 6300 SEARS TOWER CHICAGO, IL 60606			AGRAWAL, CHRISTOPHER K	
			ART UNIT	PAPER NUMBER
			3726	

DATE MAILED: 07/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/813,532

Applicant(s)

HSI-WU ET AL.

Examiner

Christopher K. Agrawal

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 April 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) 1-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 27-40, 42-44, 46 and 47 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 43 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
3. Specifically, claim 43 is confusing because it has been improperly amended in an attempt to redraft it as an independent claim. It does not contain the limitation "wherein a plurality of the nanotubes intersect and are fused to one or more other carbon nanotubes" as previously submitted but rather as newly added. Furthermore, it represents the limitation "combining the polymer foam material and the reinforcing material to form a composite insulating layer; and affixing the composite insulating layer in an uncured state to at least a substantial portion of the exterior surface of the skin" as a previously submitted limitation whereas it should be underlined as newly added. Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 27-29, 31-32, 34-36 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lak et al. (US Pub No. 2004/0256395 A1) in view of Dasch et. al. (U.S. Patent No. 5,433,906).

5. Claims 27, 28, 31 and 34: Lak teaches a method for strengthening an exterior insulation layer on an exterior surface of a skin of a cryogenic fuel tank, the method comprising (**paragraph 0001, lines 1-4 of paragraph 0006**): providing, by spraying, a quantity of a non-flammable polymer foam material (**paragraph 0003**) and a reinforcing material (**paragraph 0033 lines 1-4**), while the foam material is in a liquid state; wherein the reinforcing material comprises a plurality of strengthening fibers, wherein at least some of the strengthening fibers intersect with at least some other of the strengthening fibers and combining the polymer foam material and the reinforcing material to form a composite insulating layer; and substantially simultaneously affixing the composite insulating layer in an uncured state to at least a substantial portion of the exterior surface of the skin (**paragraph 0034**) but does not specifically teach the method wherein the strengthening fibers have diameters from about 1nm to about 1micrometer and lengths ranging from about .1micrometer to about 50 micrometer.

6. Dasch et. al. teach that it is well known and advantageous to use strengthening fibers within the claimed dimensional range for the purpose of strengthening various composites (**Figs. 1-2; Col. 1 lines 25-30; lines 45-60; Col. 2 lines 56-59; Col. 7 lines 6-20**).

7. It would have been obvious to one of ordinary skill in the art at the time of the invention to have incorporated strengthening fibers having diameters from about 1nm to

about 1micrometer and lengths ranging from about .1micrometer to about 50 micrometer as taught by Dasch with the methods of Lak for the purpose of improving strength and stiffness of composite foam especially within the context of the aerospace industry. Furthermore, Lak does teach that incorporation of a fiber matrix improves strength [0033] (note teaching of Nomex as taught in Applicant's specification). For these reasons, the claimed dimensions would have been obvious to one of ordinary skill in the art at the time of the invention for the purpose of solving the well known problem of foam strength in the art of shuttle insulation.

8. Claims 29 and 32: Lak et al. disclose spraying the exterior surface of the skin of the fuel tank with the foam material to form a first layer of foam material thereon, as explained above. Lak et al. also disclose placing at least one sheet of reinforcing material over the first layer of foam material (**paragraph 0036 lines 1-5**) and spraying a second layer of foam material on the sheet and the first layer (**paragraph 0032 lines 10-11**), and curing the foam material layers (**paragraph 0034 lines 8-9**).

9. Claim 35: Lak et al. disclose adding, placing, and adding are repeated a desired number of times to achieve sufficient strength (**paragraph 0032, lines 10-11, paragraph 0039 lines 2-5**).

10. Claim 36: Lak et al. disclose securing at least one reinforcing material layer adjacent the exterior surface of the skin (**paragraph 0036, lines 3-6**); adding a foam material layer in the liquid state in such a manner to substantially encapsulate the reinforcing material layer in the foam material layer; and curing the foam material layer (**paragraph 0036 lines 6-10**).

11. Claim 39: Lak et al. further disclose: adding a sufficient amount of reinforcing material (**paragraph 0039 lines 2-5**) so that the composite insulating layer has a compressive strength and a tensile strength (**paragraph 0033 lines 1-4**) sufficient to prevent the composite insulating layer from fracturing and being separated from the fuel tank as a result of thrust imposed on the composite insulating layer during a launch and ascent to space when the fuel tank is attached to a space shuttle orbiter (**paragraph 0045**).

12. **Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lak et al. (US Pub No. 2004/0256395 A1) / Dasch et. al. (U.S. Patent No. 5,433,906) in view of Sharpe et al. (US Patent No. 4,077,921).**

13. While Lak et al. disclose all the claimed information, as listed above, Lak et al. fail to mention the addition of discrete strengthening fibers to the insulating material before being affixed to the surface of the skin. Sharpe et al., however, teach adding a plurality of discrete strengthening fibers to the insulating material before the foam material is affixed to the exterior surface of the skin. Sharpe et al. teach adding glass fibers to a spray mixture, which is to be applied to the external fuel tank (**column 5 lines 21-22, lines 35-39; column 6 lines 26-27**). The purpose of adding the glass fibers to the foam material is to increase the strength of the foam significantly. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to add strengthening fibers such as glass to the foam in order to act as a reinforcing agent.

14. Claims 33, 37-38, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lak et al. (US Pub No. 2004/0256395 A1) / Dasch et. al. (U.S. Patent No. 5,433,906) in view of Liu (US Patent No. 5,515,216).

15. Lak et al. disclose the action of spraying the liquid foam over the reinforcing material (Lak et al. disclose the use of Nomex™, also known as poly(*m*-phenylene terephthalamide) as a reinforcing material (**paragraph 0033 line 4**)), and the skin layer of the external fuel tank, yet fails to mention the action of pouring the liquid. Lui teaches pouring (**claims 16 and 17**) the polyisocyanurate liquid foam (**column 4 lines 52-65**). The advantage of pouring the foam rather than spraying the foam is to have better control over foam placement over the object. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to pour the foam over the reinforcing material over the skin of the external fuel tank in order to have better control over where the foam is placed and how much is dispensed over an area. Furthermore, it would have been obvious to use polyisocyanurate foam to cover the external fuel tank because of its great ability as a thermal insulator.

16. Claims 42 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lak et al. (US Pub No. 2004/0256395 A1) / Dasch et. al. (U.S. Patent No. 5,433,906) in view of Liu (US Patent No. 5,515,216) and further in view of Applicants Admitted Prior Art (APA).

17. Lak et al. and Liu both disclose the use of reinforcing fibers in the polyisocyanurate foam; yet fail to mention the size of the fibers, or the cell size of the

foam. However, APA teaches carbon nanotubes have been a known art since 1991 (**page 9 lines 18-29**). Furthermore, APA teaches the size of known carbon whiskers (**page 9 lines 8-12**). APA also teaches polyisocyanurate foams having a cell size of about 200 μm (**page 8 lines 27-28**). The purpose of placing nanotubes or carbon whiskers in the foam is to greatly increase the structural stability of the foam. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to place nanotubes or carbon whiskers in the foam to increase the structural stability of the foam.

18. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lak et al. (US Pub No. 2004/0256395 A1) / Dasch et. al. (U.S. Patent No. 5,433,906) in view of Liu (US Patent No. 5,515,216) and Applicants Admitted Prior Art (APA).

19. Lak teaches a method for strengthening an exterior insulation layer on an exterior surface of a skin of a cryogenic fuel tank, the method comprising (**paragraph 0001, lines 1-4 of paragraph 0006**): providing, by spraying, a quantity of a non-flammable polymer foam material (**paragraph 0003**) and a reinforcing material (**paragraph 0033 lines 1-4**), while the foam material is in a liquid state; wherein the reinforcing material comprises a plurality of strengthening fibers, wherein at least some of the strengthening fibers intersect with at least some other of the strengthening fibers and combining the polymer foam material and the reinforcing material to form a composite insulating layer; and substantially simultaneously affixing the composite insulating layer in an uncured state to at least a substantial portion of the exterior

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surface of the skin (**paragraph 0034**) but does not specifically teach the method wherein the polymer foam is an isocyanurate closed cell foam having a cell size of about 200 micrometers or the method wherein the strengthening fibers have diameters from about 1nm to about 1micrometer and lengths ranging from about .1micrometer to about 50 micrometer.

20. APA teaches carbon nanotubes have been a known art since 1991 (**page 9 lines 18-29**). Furthermore, APA teaches the size of known carbon whiskers (**page 9 lines 8-12**). APA also teaches polyisocyanurate foams having a cell size of about 200 μm (**page 8 lines 27-28**). The purpose of placing nanotubes or carbon whiskers in the foam is to greatly increase the structural stability of the foam.

21. Lui teaches pouring (**claims 16 and 17**) the polyisocyanurate liquid foam (**column 4 lines 52-65**). The advantage of pouring the foam rather than spraying the foam is to have better control over foam placement over the object. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to pour the foam over the reinforcing material over the skin of the external fuel tank in order to have better control over where the foam is placed and how much is dispensed over an area. Furthermore, it would have been obvious to use polyisocyanurate foam to cover the external fuel tank because of its great ability as a thermal insulator.

22. Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have incorporated reinforcing intersected carbon nanotubes and isocyanurate closed cell foam with the method of Lak for the purpose of dispensing superiorly strengthened foam in a controlled fashion.

23. Claims 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lak et al. (US Pub No. 2004/0256395 A1) / Dasch et. al. (U.S. Patent No. 5,433,906) in view of Bache (U.S. Patent No. 4,588,443).

24. Lak/Dasch teach the claimed invention of claim 27 as described above but do not specifically teach the method wherein the strengthening fibers comprise silicon carbide whiskers.

25. Bache teaches that it is known and advantageous to incorporate silicon carbide whiskers into foam for the purpose of strengthening the foam and providing better fatigue properties (**Col. 63 lines 18-22; Col. 64 lines 9-14; Col. 73 line 59**).

26. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have incorporated silicon carbide whiskers as a reinforcing mechanism for the purpose of strengthening the foam and providing better fatigue properties.

Response to Arguments

27. Applicant's arguments with respect to claims 27-44 have been considered but are moot in view of the new ground(s) of rejection; however, in the interest of expedient prosecution, Examiner has addressed Applicant's remarks of April 24, 2006.

28. In response to Applicant's assertion that one would have to discard the web layer of Lak to reach the claimed invention (Remarks, page 11), Examiner respectfully disagrees. One of ordinary skill in the art would merely be required to *alter* the web

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layer of Lak to have the dimensions as desired in order to reach the newly claimed limitations.

29. With respect to Applicant's arguments that Liu, Sharpe and APA fail to teach strengthening fibers of the claimed dimensions, Examiner notes that Liu, Sharpe and APA are not relied upon for the claimed dimensions. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the web of Lak as described in the comments above for the purpose of increasing the strength of the foam insulation layer.

30. With respect to Applicant's arguments that Liu fails to teach strengthening components etc., Examiner notes that Liu is only relied upon for the pouring of liquid foam onto the application surface for the purpose of maintaining better control over application of the foam. It is not required that the secondary reference teach all of the limitations of the claim in an obviousness type rejection. Examiner notes that, with respect to Liu, Applicant is merely arguing the references independently.

Conclusion

31. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

32. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher K. Agrawal whose telephone number is (571) 272-3578. The examiner can normally be reached on Mon-Fri 8:30AM-5:00PM.

34. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Bryant can be reached on (571) 272-4526. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

35. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CKA



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